clusion as to the value of this substance as a circulatory stimulant. The drug is freely soluble in water, produces apparently no gastro-intestinal irritation, and when given by the mouth is uncertain and slow in its effect. When administered in doses from 20 to 40 mg. it produces a marked and abrupt rise of pressure, which is very fugacious, and is sometimes associated with slowing of the pulse rate and irregular heart action. The substance should be of value in the treatment of conditions in which there was marked vasomotor depression, but it apparently cannot be depended upon for any prolonged action.

I wish to express my thanks to Prof. W. E. Dixon and Dr. H. H. Dale for their assistance. Also to Dr. T. Mellor Tyson, Dr. William E. Hughes, Dr. L. N. Boston, and Dr. Ward Brinton for the privilege of selecting cases from their wards.

THE OCCURRENCE OF TRICHOMONAS HOMINIS IN GASTRIC CONTENTS WITH A REPORT OF TWO CASES.

BY FRANK SMITHIES, M.D.,

GASTRO-ENTEROLOGIST TO ST. MARY'S HOSPITAL (MAYO CLINIC), ROCHESTER, MINN.; FORMER INSTRUCTOR IN INTERNAL MEDICINE AND DEMONSTRATOR OF CLINICAL MEDICINE, UNIVERSITY OF MICHIGAN, ANN ARBOR.

SINCE the active Caucasian occupation of the Philippine Islands, the West Indies, and Central America in the last decade, the study of protozoa parasitic to the gastro-intestinal tract of man has received great impetus. New and valuable facts have been brought forward by Musgrave and Clegg,[1] Walker,[2] and others concerning the biology of amebæ and flagellate protozoa, as well as the etiology and symptomatology when such are present in the human intestinal canal. Following the pioneer work of Dock,[3] of recent years, Freund[4] and Sistrunk[5] have shown that amebæ and flagellate protozoa, which were formerly considered to be present but rarely in the feces of individuals who had never visited tropical regions, are by no means infrequent in the discharges of persons residing in the temperate zone.

With increasing amounts of material available for proper examination, it is somewhat curious that the presence of amebæ and flagellate protozoa (particularly trichomonas hominis) outside the intestines proper has not been more frequently chronicled. A rather close scrutiny of available literature reveals the fact that within the last eight years there has been but one observation detailing the presence of flagellate protozoa in the stomach, esophagus or oral cavity. In this country and abroad, it is quite likely that search for these parasites has not been made apart from intestinal discharges.

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[1] Publications of the Government Laboratories, Manila, P. I., 1904, 93; Philippine Jour. of Sci. (Manila), 1906, i, 909; ibid., 1908, iii, 77.

[2] Jour. Med. Research, 1907, No. 7, 379.

[3] Texas Med. Jour., April, 1891.

[4] Archiv. Int. Med., 1908, i, No. 1, 28.

[5] Jour. Amer. Med. Assoc., 1911, lvii, 1507.

Nearly fourteen years ago Skaller[6] reported 2 cases of carcinoma at the cardiac end of the stomach where flagellates similar to "trichomonas vaginalis" (Donne,[7] Dock[8]) were discovered in the gastric extracts as well as in the patient's stools. Shortly afterward Strube[9] recorded a similar case, a male patient, with foul-smelling vomitus and a "hard tumor" in the epigastrium. A few years later Cohnheim[10] described the presence of trichomonas hominis in a case clinically diagnosticated "gastritis," in the test-meal extract of which the total acidity was 19 and the free hydrochloric acid was estimated at 12, and in a second case clinically "carcinoma ventriculi" amebæ were occasionally present. Following Cohnheim, Zabel[11] reported 3 cases where he had demonstrated flagellate protozoa in both gastric and intestinal contents. Two of his cases were diagnosticated "achylia gastrica." These had leptothrix, amebæ, spirillæ, and trichomonas hominis in the vomitus, gastric washings, and the stools. The third case was one of carcinoma of the stomach, at first with slight interference with motility, but later with marked retention and the presence of lactic acid. Megastoma entericum was demonstrated in the gastric extracts. Cohnheim[12] shortly after stated that he had seen cercomonas hominis and trichomonas hominis in cancerous involvements of the tongue and esophagus and also in the mouths of individuals with carious teeth. This observation was verified by von Leyden.[13] So far as we have been able to discover, the most complete study of flagellates in gastric extracts has been made by Rosenfeld.[14] He comments upon the fact that trichomonas hominis has been reported usually in extracts that show achylia, but claims that this does not necessarily follow inasmuch as one of his cases had a free hydrochloric estimation of 6 and a total acidity of 37. Rosenfeld describes 6 instances of the presence of trichomonas hominis in gastric contents, where carcinomas involved various positions in the wall of that viscus. They were frequently accompanied by long bacilli (Boas-Oppler) and leptothrix. The number of flagellate protozoa increased in proportion to the diminution of acidity and as retention progressed. All Rosenfeld's patients exhibited cachexia and palpable tumor in the epigastrium.

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[6] Berl. klin. Woch., June, 1898, 551.

[7] Compt. rend. de. l'Acad. des Sc., 1836, iii, 385.

[8] AMER. JOUR. MED. SCI., January, 1896, 1.

[9] Berl. klin. Woch., 1898, No. 32, 708.

[10] Deutsch. med. Woch., 1901, No. XXVII.

[11] Arch. f. Verdauungskrank., 1901, vii, 509.

[12] Deutsch. med. Woch., 1902, 174.

[13] Ibid., 182.

[14] Ibid., 1904, xxx, 1717.

We have not been able to discover a report of the finding of trichomonas hominis in gastric extracts outside of Continental literature. Perhaps a routine search for this parasite has not been made in gastric contents. Observations upon its occurrence in the stools of patients living in the northern half of the United States are rapidly becoming more numerous, as the recent study of Sistrunk[15] demonstrates. It would seem timely to place on record somewhat fully the following 2 cases where trichomonads were demonstrated in gastric extracts. Search for this and other parasites in gastric contents may thereby be stimulated.

I.

CASE REPORTS.

CASE I.—Mrs. G., aged twenty-eight years, a native of the mineral well district of Texas, was referred by Professor Aldred Scott Warthin, Ann Arbor, Michigan, August 17, 1908.

Subjective Symptoms. Severe headaches, coming on paroxysmally, especially following exertion, excitement, etc.; attacks of "dyspepsia," namely, nausea, belching of gas, with "sore stomach;" obstinate constipation and general weakness.

Family History. Negative.

Personal History. Was a healthy child, raised in southern Texas; married at sixteen, a widow at nineteen. Was operated upon at that time for "ovarian trouble;" made a good recovery and then commenced the study of nursing at Dallas, Texas. Later, had her appendix and one ovary removed. She overworked at the nurses' training school and had a "nervous breakdown" when aged twenty-four years. Was again married a year later, although she was not well at the time, complaining of "sore stomach," dyspepsia, and weakness. She was nauseated constantly, but never vomited. Habitual constipation resulted in hemorrhoids, which required several operations before she became comfortable. At these operations she lost much blood. The hemorrhoids bled especially freely again in the spring of 1908. Menstruation has been generally regular; patient never pregnant, never passed clots nor had leucorrhea. No urinary symptoms.

The present trouble dates back about two years. The main symptoms have been loss of appetite, nausea, distress after eating a hearty meal, belching of gas, severe prostrating headaches, and weakness. The headaches are most frequent and severe when the "dyspepsia" is most troublesome and when constipation is marked. The patient has lost ten pounds in weight during the last nine months. Constipation has been relieved by raw fruit and fresh vegetable diet and large draughts of a Texas mineral well water, not boiled.

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[15] Loc. cit.

Examination. Temperature, 98.8; pulse, 68; respiration, 22 (3 P.M.).

Patient of medium build with moderate amount of panniculus; skin pale, sallow throughout, but not jaundiced; sclerotics and mucous surfaces pale but not jaundiced; tongue has a moderately heavy, grayish yellow, adherent coat; breath, heavy.

Mouth, nose, and throat, negative. Reflexes, negative. Thorax, negative.

Abdomen, slightly distended, navel above the level of the ribs. Slight tenderness in right iliac fossa; both kidneys easily palpable; liver and spleen negative. Rather marked gurgling throughout entire abdomen; splashing sounds on tapping between navel and pubis. On inflation, stomach holds 28 bulbs without discomfort; the lesser curvature distinctly seen at one finger's breadth above the navel in the midline, while the greater curvature is made out at four fingers' breadth below the navel in the median line.

Pelvis, right ovary and tube removed; left ovary free; uterus in good position and free; pelvic floor moderately strong; external genitalia negative (Dr. Frank Witter).

Blood: Red blood corpuscles, 4,500,000; white blood corpuscles, 6210; hemoglobin, 95 per cent. Differential formula (350 white cells counted). Small lymphocytes, 11.14 per cent.; large lymphocytes, 4.6 per cent.; transitionals, 0.57 per cent.; polymorphonuclears, 74.5 per cent.; eosinophile polymorphonuclears, 1.7 per cent.; myelocytes, 0.28 per cent.; mast cells, 0.28 per cent.; degenerates, 5.1 per cent.

Urine: Negative, chemically; no parasites seen.

GASTRIC EXAMINATION: Test meals. August 19, shredded wheat biscuit meal removed after forty-five minutes. Light yellow, gastric odor, particles well broken up; 65 c.c. recovered; lavage clear after 2 liters of water.

Chemical examination: Total acidity, 40; free Hcl., 30; Uffelmann and organic acid absent.

Microscopic examination: Numerous very active, flagellate protozoa, the majority with "ground-glass" appearing bodies; a few sluggishly moving and darker. In warm preparations, four anterior flagellæ discernible; undulating membrane seen with difficulty. The organism was recognized as trichomonas hominis and demonstrated as such to several colleagues. Many motile and non-motile bacilli. Few meat fibers well broken up; starch, erythrodextrin.

Pepsin and rennin reduced. Occult blood—negative (guaiac and old turpentine method).

August 20. Shredded wheat biscuit meal; removed sixty-seven minutes after eating; 73 c.c. recovered; lavage clear after 3 liters of water. Extract, light yellow, gastric odor; test food well broken up.

Chemical examination: Total acidity, 45; free Hcl., 20; Uffelmann, Pettinkofer's, organic acids, and occult blood absent.

Microscopic examination: Few short non-motile rods; no flagellate protozoa or amebæ seen; slight microscopic food retention.

Pepsin and rennin present but reduced.

August 21. Shredded wheat biscuit meal removed thirty-five minutes after eating; 40 c.c. recovered; light yellow, gastric odor; mucus in slight excess. Lavage and test-meal fluid, warm normal saline solution.

Chemical examination: Total acidity, 18; free Hcl, 6 (doubtless not accurate on account of normal salt being administered with test food). Uffelmann, Pettinkofer, organic acid, and occult blood absent.

Microscopic examination: Enormous number of very actively motile trichomonads seen. Many dying and dead forms, some coarsely granular and some vacuolated. In some, when the preparation was diluted with warm saline solution, undulating membranes well discernible. The trichomonads appear smaller than those seen in this patient's stool (see below) but are quite as motile. As nearly as could be estimated the average length of the body was about 12 microns. No measurements of the tails were made. Specimens were kept on the warm stage the greater part of the morning, and with the frequent addition of warm saline solution, actively motile forms were preserved. Cold, or warm, acid and alkaline solutions rapidly killed the flagellates (hydrochloric acid above 0.3 per cent.; acetic acid, nitric acid; caustic soda, caustic potash, 1 per cent. lactic acid, 0.5 per cent. salicylic acid, and 1 per cent. carbolic acid solutions were used). When the gastric extracts were diluted with aniline dye preparations (methylene blue, Gram's mixture, gentian violet, Wright's stain) in an attempt to stain the organisms, the smears showed small, contracted, scarcely recognizable dead organisms. Tubes of blood serum and glucose agar inocculated with 5 drops of gastric extract, in which actively motile trichomonads were present in large numbers, revealed not even recognizable dead organisms the following day, although there was an abundant growth of bacilli. In the gastric extract itself incubated in three volumes of normal saline solution, no trichomonads could be made out after twenty-four hours.

August 22. Fasting stomach; patient tubed at 8.25 A.M. No contents obtained. Lavage with warm normal saline solution was clear with the exception of small amounts of mucus. In the examination of seven specimens of the lavage water and bits of mucus, only one trichomonad was seen. This was found in a bit of dense mucus and was not motile, even though the preparations had been kept warm since they were secured.

August 22. Riegel dinner removed at 4.45 P.M., 160 c.c. recovered. Lavage clear after 4 liters of warm saline solution. Extract showed, macroscopically, much poorly chewed food.

Chemical examination: Total acidity, 16; free Hcl, 8; Uffelmann, Pettinkofer, organic absent; occult blood, faint positive (guaiac and old turpentine method).

Microscopic examination: Several small, granular, sluggishly motile trichomonads seen; flagellæ very difficult to observe, even with subdued light. Many long slender, non-motile bacilli, usually in pairs. Food debris in various stages of digestion; mucus in excess.

EXAMINATIONS OF STOOLS. August 22. Large, greenish-brown stool following 1 ounce of domestic Carlsbad salts. Stool has peculiar foul, penetrating, musty odor. Much partly altered food and mucus, in tenacious strings and flakes. Reaction—alkaline to litmus.

Chemical examination: Skatol, positive. Occult blood, faintly positive.

Microscopic examination: Enormous numbers of large (15 to 22 microns approximately) actively motile trichomonads; no amebæ; great numbers of long slender motile and non-motile bacilli; much food debris, poorly digested; mucus in excess.

PROGRESS OF THE CASE. The following treatment was suggested: Hydrargyri chloridum mite, grains v, in divided doses at bed time, followed by 1 ounce of salts before breakfast the following morning. This medication was given twice weekly, and the stools were saved after each bowel movement. Acidum hydrochloricum dilutum was given in doses of xxx drops a half hour after meals, and repeated an hour and a half after each meal. Gastric lavage on empty stomach, with large quantities of 1 per cent. sodium salicylate solution was carried out three times weekly. Intestinal diet and boiled water were ordered.

After the patient had had two "rounds" of calomel and salts, and several lavages of salicylate of soda, trichomonads were no longer present in either gastric contents or stools. Flatulence, nausea, headaches, and weakness disappeared. The patient felt so well that in late September a trip to Canada was allowed. On October 3, she again reported saying that she felt well, although she had not been under treatment while away from Ann Arbor. A specimen of gastric contents showed no flagellate protozoa. A fresh stool examined after Carlsbad salts had been administered showed enormous numbers of motile bacilli, much mucus and many triple phosphate crystals. Examination of four fresh preparations on the warm stage revealed one large, very actively motile trichomonad.

On October 6 the patient was given 50 grains of thymol, in two doses, at bedtime, combined with 2 grains of calomel. At 7 A.M.

the following morning an ounce of Carlsbad salts was administered. The stool was foul smelling, and contained much poorly digested food, but few motile bacilli and no trichomonads were seen.

The patient went South on October 10, feeling very well. Her physician (Dr. Benj. Beeler, Mineral Wells, Texas), was advised regarding the condition present, and with his aid treatment was carried out along the above lines. The last time information was received from the patient (Spring, 1910), she was in excellent health, had gained weight, and had had no further return of protozoa in either gastric extracts or stools.

CASE II.—Mrs. J., aged forty-seven years, native of Michigan; referred by Dr. F. N. Bigelow, Holly, Michigan, April 20, 1909.

Subjective Symptoms. Feeling of weight high in epigastrium, immediately after eating, "sourness" of stomach, with bitter eructations, flatulence; obstinate constipation; very annoying cough; facial neuralgia; palpitation of heart; nervousness.

Family History. Sister died of pulmonary tuberculosis; otherwise negative.

Personal History. Good health until four years since. Never pregnant.

Present Trouble. About four years ago had stomach disturbances, which were diagnosticated "dilatation and fermentation;" suffered from chronic constipation and hemorrhoids; had a Whitehead operation performed for the hemorrhoids, and at that time lost a great deal of blood, with resultant weakness. After operation, stomach trouble appeared to improve. The patient *spent the last three winters in Florida.*

In the fall of 1908 had bronchopneumonia; convalesced in Florida; improved slowly; developed "whooping cough," which was so severe that vomiting frequently occurred, especially at night. Has been losing appetite, strength, and weight during the last six months. Recently developed distressing sense of weight high in the epigastrium, most marked immediately after eating, with acid eructations and regurgitation of but slightly altered food; character of food makes little difference in this respect; the eructations frequently last for two hours after meals, and are worse when lying down; vomiting relieves. Of late constipation has become very obstinate, requiring strong cathartics. When constipated, neuralgia and nervousness are aggravated.

Examination. Temperature, 99; respiration, 36; pulse, 92 (4 P.M.).

A moderately large, thick-set woman of asthmatic type; appreciable cyanosis of tip of nose, ears, and of lips; coughs frequently, and paroxysmally, cough having a slight "brassy" ring; sclerotics slightly injected.

Tongue heavily coated; throat—"marked enlargement, of true aneurysmal type of the ascending pharyngeal artery, from the level of the larynx to just above the orifice of the Eustachian tube; the vessel shows marked pulsation throughout the entire field of observation" (report of Professor R. Bishop Canfield).

Neck: Marked carotid pulsation on right; no tracheal tug, or positive venous pulsation.

Thorax: -Diffuse bronchitis, more marked in left lower back; moderate cardiac hypertrophy. Blood pressure: Systolic, 145; diastolic, 104 (Riva-Rocci, 12 cm. cuff.).

Abdomen: Distended and tympanitic; gurgling sounds throughout; stomach by inflation extends two fingers' breadth below the navel in the midline; tenderness high in the epigastrium and over the gall-bladder.

Radiogram: Moderate cardiac hypertrophy; great vessels negative; pulmonary edema; "dilated esophagus" (Dr. V. J. Willy).

Urine: Trace of albumin in twenty-four-hour sample (acetic and ferricyanide test).

Sputum: "Curshmann's spirals;" few alveolar cells containing blood pigment.

Blood: Red blood corpuscles, 4,560,000; white blood corpuscles, 5240; hemoglobin, 90 per cent. Differential formula—(516 white cells counted). Small lymphocytes, 9.7 per cent.; large lymphocytes, 3.1 per cent.; transitionals, 6.4 per cent.; polymophonuclear neutrophiles, 66.8 per cent.; eosinophile polymophonuclears, 2.4 per cent.; myelocytes, 0.5 per cent.; degenerates, 10.8 per cent. No atypical red cells.

GASTRIC EXAMINATION. April 28. Test meal: Shredded wheat biscuit and distilled water; removed seventy minutes after eating. Stomach tube passed with difficulty on account of enlarged vessel in throat; patient vomited 80 c.c. of partly altered test-meal food chiefly before tube passed into stomach; 40 c.c. of a canary-yellow fluid removed through tube; the latter contained an excess of mucus, together with well-broken up food, and had a very sour odor.

"Vomitus:" Straw colored, slightly sour odor; shredded wheat biscuit poorly broken up; Congo and Gunzberg test faintly positive.

Chemical examination: Total acidity, 4; free Hcl, 4; occult blood, organic acid, and Pettinkofer absent.

Microscopic examination: Poorly digested shredded wheat biscuit; one sluggishly moving, flagellate protozoon, with granular endoplasm; many motile bacilli.

Gastric Extract. Chemical examination: Total acidity, 56; free Hcl, 18; Uffelmann, Pettinkofer, occult blood (guaiac and peroxide of hydrogen test) and organic acid absent.

Microscopic examination: Many rather small (average about 8 microns) granular appearing, sluggishly motile trichomonads; many globular, vacuolated, and contracted forms, apparently dead; many leukocytes and cell nuclei; enormous numbers of actively motile, long, and slender bacilli; food particles, potato starch, shredded wheat biscuit fibers, few meat fibers well preserved, mucus in marked excess.

Digestion. Pepsin and rennin present but greatly diminished.

May 1. Fasting stomach; patient tubed at 9.15 A.M., 45 c.c. canary-yellow fluid removed, mixed with shaggy strips of mucus, bits of hard egg and toast; lavage with warm normal saline solution, clear after about 3 liters. Some of the first contents recovered, appeared to come from the esophagus, and were Congo negative.

Chemical examination: Total acidity, 22; free Hcl, 14; Uffelmann, occult blood, and organic-acid tests negative. Pettinkofer, faintly positive. Pepsin and rennin—trace.

Microscopic examination: Few slightly motile, darkly granular trichomonads; many ovoid, balloon-shaped, and globular forms, exhibiting coarse endoplasm, frequently with large vacuoles; many short non-motile bacilli, single and in chains of from four to six; cell nuclei increased; much mucus, and microscopic food retention. This patient was not given a Riegel dinner at this time, on account of the danger of tubing due to the aneurysm of the ascending pharyngeal artery.

STOOL EXAMINATIONS. April 29. Fresh specimen secured after administration of 1 ounce of domestic Carlsbad salts on empty stomach. Large, greenish yellow, foamy, semi-fluid stool, with penetrating, acrid, and musty odor; large strings of mucus, mixed with small particles of food remains.

Chemical examination: Indol and skatol, positive; occult blood, positive (guaiac and peroxide of hydrogen test).

Microscopic examination: Enormous numbers of very actively motile, generally pyriform trichomonads. The majority had finely granular bodies, and were uniformly larger than those seen in the gastric extracts of the day previous and subsequently. Some were very large, measuring from 20 to 28 microns. With subdued light, and when the protozoa were dying or entangled in mucus or food debris, four anterior flagellæ and the undulating membranes could be made out. On the warm stages, specimens were kept the greater part of a forenoon, before they became sluggishly motile, coarsely granular, contracted or large and vacuolated, preceding their death. Attempts were made to obtain stains by the carmine and the osmic acid-Wright-stain methods (as elaborated by Freund under Professor Dock's direction at the University Hospital, Ann Arbor), but with no success. The cell bodies appeared to become disintegrated in the drying and fixing, so that only poorly stained debris showed. Probably greater experience with these methods would have led to more satisfactory results. Attempts at culture in the following media were made: (1) Human blood mixed with mucus from feces which had been previously washed in warm normal saline solution; (2) bouillon mixed with blood serum; (3) normal saline solution alone; (4) 0.5 per cent. lactic acid; 5 per cent. blood serum in normal saline solution; (5) solutions of 5 per cent. and of 10 per cent. ox bile in sodium citrate in normal saline solution; (6) ox bile alone; (7) 5 per cent. ox bile, and 5 per cent. blood serum, with 0.5 per cent. lactic acid in normal saline solution; (8) 5 per cent. ox bile, 5 per cent. blood serum in beef bouillon; (9) alkaline saliva. All methods were unsuccessful. Cold water or salt solution, or these above 110° F., rapidly caused death of the trichomonads. Solutions of organic and inorganic acids (markedly acid to litmus) and of alkalies (markedly alkaline to litmus) caused rapid disintegration of the parasites.

In the stool, in addition to the flagellates were vast numbers of actively motile bacilli. There was much poorly digested food and mucus.

May 1. Stool passed without cathartic. Medium size, in flat ribbons, soft, coated with mucus; of penetrating musty odor.

Chemical examination: Occult blood, and indol negative. Schmidt's bichloride test, bilirubin.

Microscopic examination: No trichomonads in either liquid parts of stool or in bits of mucus, although nine specimens were examined carefully; many motile bacilli; much poorly digested food.

TREATMENT. This case was treated similarly to Case I, with the exception of frequent lavages. A preliminary lavage with 1 per cent. solution of sodium salicylate was given; after that "rounds" of calomel and salts, with doses of hydrochloric acid after meals. Frequent small feedings with intestinal diet relieved the epigastric distress, the regurgitations, and the flatulence. A sedative controlled the coughing by lessening the arterial pulsations that constantly tugged at the larynx.

On June 3, the patient felt very well, had no gastric or intestinal protozoa and returned home. She was seen again, with Dr. Bigelow, in the Fall of 1910. Exposure while on a camping trip had brought on cough and some return of old symptoms in the stomach. The esophagus and gastric extracts showed no flagellate protozoa. The stools exhibited many sluggishly motile trichomonads, numerous motile bacilli, and an excess of mucus.

The patient was given a preliminary treatment of calomel and salts and when the intestinal tract was well emptied had 60 grains of thymol administered in two doses at bedtime. This was followed by a saline cathartic the following morning. The stool showed no flagellate protozoa, and few motile bacilli. The patient returned home under treatment and has not been heard of since.

II.

Inasmuch as the above cases have been considered in detail, clinically, but little further comment appears necessary. However, it would seem proper to briefly emphasize certain facts.

Both patients were women who had resided in semi-tropical climates; both had been weakened by illness and loss of blood incident to surgical procedures; both patients had habitually partaken of unboiled water from surface wells and had doubtless also eaten freely of fresh, moist, green vegetables and fruit in all probability contaminated. Neither patient had experienced periodic or chronic diarrhea; on the contrary, obstinate constipation was present in spite of the existence of enormous numbers of flagellate protozoa and motile and non-motile bacteria in the intestinal tract. This is somewhat unusual where trichomonads are present, but the condition has also been observed by Freund[16] (Case VII, his series) and others. In each case, gastro-intestinal symptoms were prominent. These were nausea, flatulence, abdominal distention, colicky pains, and constipation. Skatol and indol were present in the stools and so-called "intoxication symptoms," as headaches, neuralgia, and exhaustion were observed. The blood showed slight anemia, with increase in eosinophiles and degenerated leukocytes.

The test meal revealed microscopic retention—lowered total and free hydrochloric acid (shredded wheat biscuit meal) as well as increased amount of mucus containing great numbers of bacteria and trichomonads. The stools were the characteristic greenish-brown, semi-liquid variety of protozoan infection after Carlsbad salts have been administered. Bits of mucus, occasional altered blood, rich flora, and partly digested food were concomitent with the large numbers of trichomonas hominis.

In these patients one can only surmise the source of the infection of the esophagus, stomach, and intestines by the flagellates. It may be that the finding of the protozoa in the esophagus and stomach was secondary to a primary focus in the duodenum and jejunum, the organisms passing upward through insufficient sphincter pylori. It seems probable also that the trichomonads were ingested with food and water. Some of them, protected by mucus in the lower esophagus and in the stomach may not have been immediately killed by the acid gastric secretion.

Food and water may be contaminated readily in a great many ways. Flagellates may exist in the sputum of patients with tonsillar or nasal abscess (Leuckhart[17]) or in sputum from non-tuberculous lung cavities, for example, bronchiectasis (Litten,[18] Lenhartz[19]), or where individuals are affected with markedly carious teeth (v. Leyden,[20] Prowazek,[21] Theobald[22]), or oral cancer (Cohnheim). Dock[23] has mentioned the finding of trichomonads in the discharges of snails, frogs, and ducks. The stools of patients affected with typhoid fever, amebic dysentery, cholera or enteritis, primary or secondary to malignant disease of the stomach or bowel, may be rich in trichomonads (Dock,[24] v. Jaksch,[25] Epstein,[26] Davaine,[27] Grassi,[28] May,[29] et al.). Hunt[30] has reported the finding of flagellates in perineal abscess, Cunningham[31] noted their presence in a case of abscess of the liver. As Dock[32] has observed, the presence of trichomonads in urine may be responsible for wide dissemination. The possibility of resistant spore forms of the flagellates explains their viability under adverse conditions.

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[16] Loc. cit.

[17] Die Parasiten des Menschen, 2d Aufl., Band I, p. 315.

[18] Beit. z. Zentralbl. f. klin. Med., 1886, No. 5, 69.

[19] Microscopie und Chemie am Krankenbette, p. 61 (Dock).

Morphologically, the parasite seen in the 2 cases here reported differs very little from the classic picture of trichomonas hominis as established by Donne[33] and Dock.[34] Inasmuch as the protozoa described by these and other observers and ourselves showed four anterior flagellæ together with an undulating membrane, it would seem that the "new" form of trichomonas recently described by Alexieff[35] conforms only to type. It might be observed that the trichomonads seen in the gastric extracts in our cases were approximately but half so large as those found in the stools of the same host. They seemed less resistant to external influences, but in other respects resembled the larger variety.

The cases presented contribute no facts regarding the much debated question of trichomonas hominis as an etiological factor. Certainly its removal in quantity from the gastro-intestinal tract of its host is attended by clinical benefit. It has been advanced frequently that the presence of great numbers of flagellates acts as a mechanical irritant to the intestinal mucosa or that such protozoa secrete a substance which is irritant. While these observations may be true, we feel that other factors might be considered.

The rapid multiplication of intestinal bacteria and protozoa (as trichomonads) results in a great quantity of protein-containing flora in all stages of viability. In the life cycle of the trichomonas dead forms necessarily result. What action succus entericus or associated bacteria and the like have toward hastening this death we are not prepared to state. The dead forms impose upon the digestive juices an excess of protein ("foreign proteid") for cleavage

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[20] Loc. cit.

[21] Arch. f. Parasitenkunde, 1902, p. 166.

[22] Centralbl. f. Bakteriologie, 1904, p. 86.

[23] Loc. cit.

[24] Loc. cit.

[25] Wien. klin. Woch., 1888, xxv, 511.

[26] Präger med. Woch., 1893, No. 38, 40.

[27] Compt. rend. de la Societe de Biologie (Paris), 1854, i, 129.

[28] Zeitschr. f. klin. Med. (Berlin), 1897, xxxi, 442 (Janowski).

[29] Arch. f. klin. Med., 1892, Band xlix, 51.

[30] Lancet, London, July, 1906, 28.

[31] Quart. Jour. Mic. Sci., 1881, xxi, 234.

[32] Loc. cit.

[33] Loc. cit.

[34] Loc. cit.

[35] Compt. rend. Soc. de Biologie (Paris), 1909, lxvii, 712.

As the work of Vaughan[36] and his associates has shown, this protozoic protein can be considered homologous to any other protein, chemically. The hydrolization (cleavage) of this protein by digestive ferments or associated bacterial enzymes, results in the production of so-called "toxic" and "non-toxic" groups. These may be further split to amino acids or simpler radicles. It is suggested, in view of these facts, that these cleavage products of the protein contained in the flagellates may be a not inconsiderable influence either as (1) a gastro-intestinal irritant; (2) a factor in altering metabolic change in digestive glands; (3) a source of so-called "intoxication symptoms" clinically.

SACRO-ILIAC DISPLACEMENT.

BY JAMES K. YOUNG, M.D.,

ASSOCIATE PROFESSOR OF ORTHOPEDIC SURGERY, UNIVERSITY OF PENNSYLVANIA; PROFESSOR OF ORTHOPEDIC SURGERY, PHILADELPHIA POLYCLINIC; CLINICAL PROFESSOR OF ORTHOPEDIC SURGERY, WOMAN'S MEDICAL COLLEGE, PHILADELPHIA.

IN order to facilitate a study of sacro-iliac displacements, and to arrive at a clearer understanding of the parts involved, it becomes necessary to review the anatomical peculiarities of that articulation, as well as the mechanism of the pelvis, with its correlated structures, in so far as they relate to the subject about to be discussed.

ANATOMY. The sacro-iliac articulation partakes both of the nature of a true and a half joint. It possesses a hyaline articular cartilage, a synovial membrane, and a capsule, and it derives its strength and toughness from its anatomical position as well as from its powerful ligamentous attachments.

This pelvic joint which is formed by the opposed cartilage-covered surfaces of the sacrum and ilium, separated by a synovial cavity enclosed in the sacro-iliac ligament, is well fortified by many layers of strong ligamentous fibers, that not only fill the interval between the two contiguous bones, but are firmly attached to the rough iliac area behind its articular surface and which extend to the back of the lateral masses of the sacrum.

This posterior sacro-iliac ligament is far more important than the oblique sacro-iliac, which passes from the posterior superior iliac spine to the second and third sacral vertebræ. The iliolumbar ligament, a triangular band of strong fibers, and the sacrolumbar ligament, a bundle of diverging fibers, likewise contribute

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[36] Vaughan, Cumming, and Wright, Zeitschr. f. im. und exp. Therapie, Band ix, Heft 4, 1911, May 13.